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What is the effect of a physical activity program on foot structure & function in overweight & obese children?

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Abstract

It has been speculated that the higher peak pressures typically generated beneath the feet of overweight/ obese children may result in excessive discomfort of these children's developing feet (Mickle et al. 2006, Dowling et al. 2001), in turn, acting as a deterrent to them participating in physical activity. Apart from perpetuating the cycle of obesity via decreased energy expenditure, physical inactivity in young children can restrict opportunities for these children to develop basic motor skills and, possibly, proper musculoskeletal development. We postulated that an intervention designed to improve fundamental movement skill (FMS) performance in overweight and obese young children may influence development of the children's base of support, the feet, during locomotor skills. Therefore, the aim of the present study was to examine the effects of a FMS intervention program on foot structure and function in young overweight and obese children.

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WHAT IS THE EFFECT OF A PHYSICAL ACTIVITY PROGRAM ON FOOT STRUCTURE & FUNCTION IN OVERWEIGHT & OBESE CHILDREN?

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1. INTRODUCTION

It has been speculated that the higher peak pressures typically generated beneath the feet of overweight/obese children may result in excessive discomfort of these children's developing feet (Mickle et al. 2006, Dowling et al. 2001), in turn, acting as a deterrent to them participating in physical activity. Apart from perpetuating the cycle of obesity via decreased energy expenditure, physical inactivity in young children can restrict opportunities for these children to develop basic motor skills and, possibly, proper musculoskeletal development. We postulated that an intervention designed to improve fundamental movement skill (FMS) performance in overweight and obese young children may influence development of the children's base of support, the feet, during locomotor skills. Therefore, the aim of the present study was to examine the effects of a FMS intervention program on foot structure and function in young overweight and obese children.

2. METHODS

Forty five overweight/obese consenting children (age = 7.7 ± 1.2 yr) were randomly assigned to one of three intervention groups: a FMS program, a dietary education program (active control group) and a combined FMS+diet program. The three interventions involved 10 weeks face-to-face (1/week) followed by program maintenance up to 6 months. Variables characterising the children's obesity (body mass index; BMI), FMS proficiency (gross motor quotient; GMQ, locomotor and object-control skills), and foot structure (arch height and midfoot fat pad thickness) and function (dynamic plantar pressures) were quantified pre-intervention and at 6 months follow-up (post-intervention). Midfoot plantar fat pad and arch height during static weight-bearing were quantified using a Sonosite® 180PLUS ultrasound system. An emed AT-4 pressure platform (2-step method) was used to quantify plantar pressure distributions.

3. RESULTS

No significant between-group differences were identified for any of the independent variables. However, significant pre- and post-intervention differences were evident in body mass for the FMS group, BMI for the dietary group, and height and forefoot pressure distribution for all groups. Although two-way repeated measures ANOVA indicated a significant main effect of height growth over the 6 months, no significant interactions between time and intervention programs were identified for any of the foot parameters or FMS outcomes. All children improved their FMS skills from pre- to post-intervention, except the dietary group who reduced their object-control performance over the 6 months. Only the combined FMS+diet group displayed a significant improvement in all motor skills (Table 1).

Table 1. Group characteristics at baseline and six months

	Diet (n = 12)		FMS (n = 13)		FMS+diet (n = 21)	
	Pre	Post	Pre	Post	Pre	Post
Mass (kg)	47.7	47.9	46.9	**48.7**	44.6	45.6
Height (m)	1.40	**1.43**	1.39	**1.42**	1.34	**1.38**
BMI (kgm^2)	24.3	**23.3**	23.9	23.8	24.2	23.7
Fore1 P (kPa)	165.5	**195.3**	161.7	**194.3**	172.4	**230.9**
Fore2 P (kPa)	268.3	270.6	293.2	320.7	253.7	273.4
Mid P (kPa)	66.4	78.2	65.6	73.3	74.5	87.4
Fore1 C (cm^2)	11.9	17.1	11.0	11.0	11.6	11.8
Fore2 C (cm^2)	9.5	14.1	9.3	9.5	9.2	9.1
Mid C (cm^2)	3.3	4.1	3.5	2.9	4.6	4.9
Arch ht (mm)	22.4	23.4	23.3	23.6	23.3	24.1
Fat pad (mm)	4.5	4.4	4.2	4.4	4.6	4.6
GMQ	58.0	58.5	60.3	65.7	61.3	**68.1**
Locomotor	3.08	3.25	3.62	4.54	3.52	**4.95**
Object-control	2.92	2.75	3.15	3.62	3.52	**4.57**

Pre = baseline, Post = 6 months, Fore1 = 1st metatarsal head, Fore2 = 2nd metatarsal head, Mid = medial midfoot, P = pressure, C = contact, ht = height, **significant difference ($p < 0.05$)**

4. DISCUSSION & CONCLUSION

Subject growth during the 6-month program was accompanied by corresponding increases in plantar pressures as the children's increased body mass was not accompanied by significant changes in plantar contact area. Although the children generally improved their FMS performance by way of the intervention, foot structure or function did not appear to be altered via the 6 month FMS program. However, effects of the FMS intervention are currently being monitored at 12- and 24-month follow up to determine possible effects of changes in the children's motor performance on foot structure and function, including plantar pressure distributions.

5. REFERENCES

Mickle *et al.* Int J Pediatr Obes 1:183-188, 2006.
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